(12) UK Patent Application (19) GB (11) 2 282 012 (13) A

(43) Date of A Publication 22.03.1995

(21) Application No 9415514.0

(22) Date of Filing 01.08.1994

(30) Priority Data
(31) 9309455 (32) 30.07.1993 (33) FR

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(51) INT CL[6]
H02K 5/128 3/487

(52) UK CL (Edition N)
H2A AKB4B3 AKF1A AK112 AK117 AK213S AK214S AK215S AK216S AK220S AK303S AK304S

(56) Documents Cited
US 4876469 A US 4179635 A US 4146809 A

(58) Field of Search
UK CL (Edition M) H2A AKB2 AKB3 AKB4B2 AKB4B3 AKF1A AKH1
INT CL[5] H02K 3/487 5/128

(54) **Supporting a partition in a dynamo electric machine**

(57) The invention relates to a rotary machine whose stator bore 2 is designs for accommodating a partition 8, the stator of the machine comprising coils 3 retains in slots by slot closing shims 6, a ripple spring being provide between the coil 3 and the shim 6. The shims protrude into the bore 2 and elastically retain the partition in the bore by the pressure exerted by the springs on the shims. Alternatively, in arrangements having oil flow channels 14, coil springs may be used.

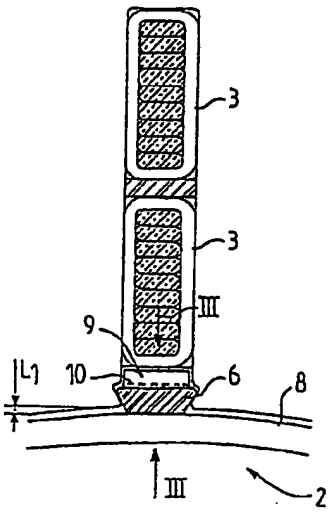

FIG. 2

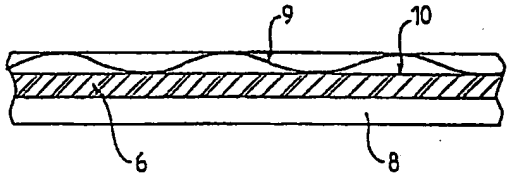

FIG. 3

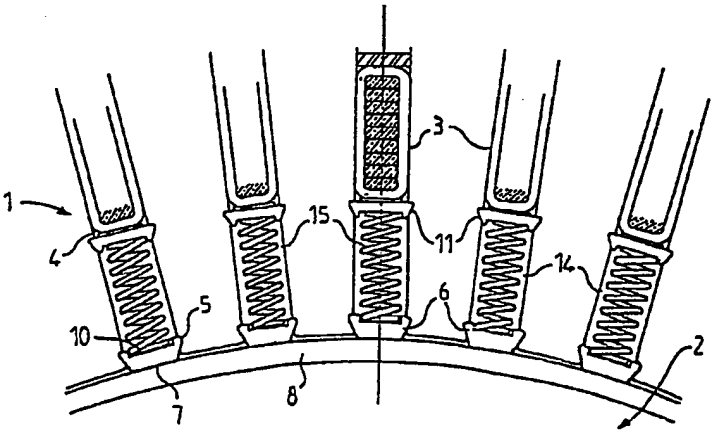

FIG. 4

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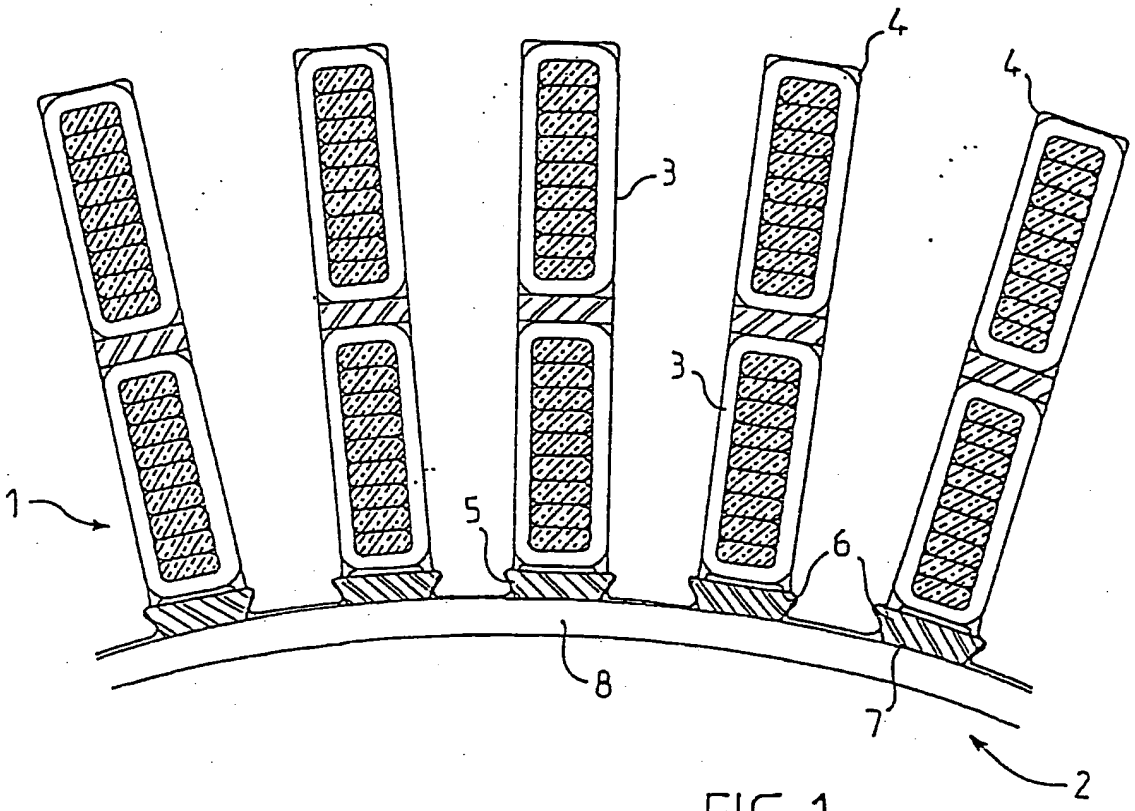

FIG.1

STATE OF THE ART

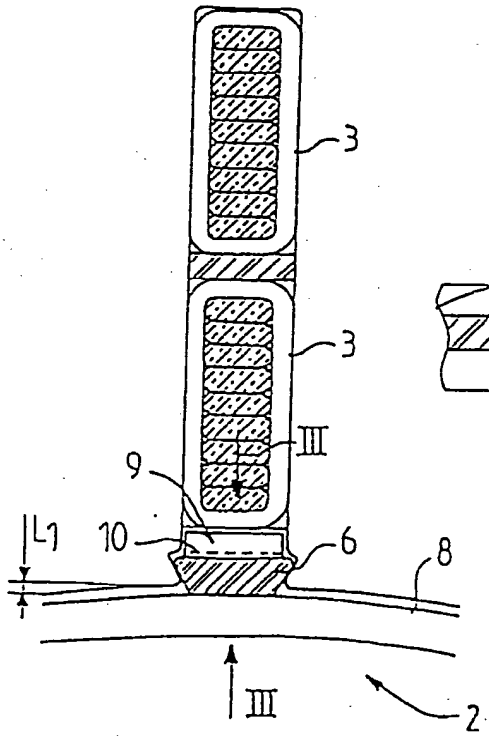

FIG.2

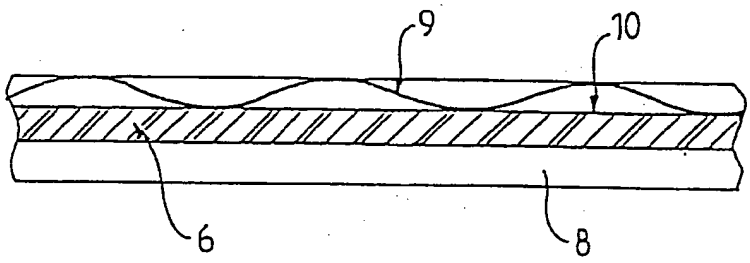

FIG.3

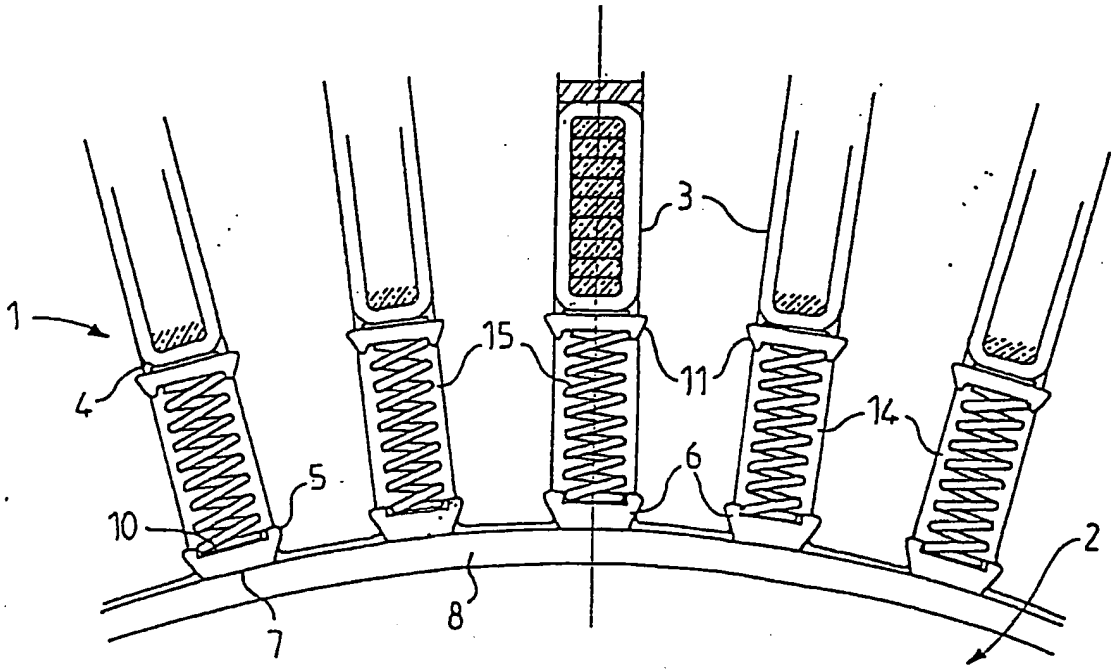

FIG. 4

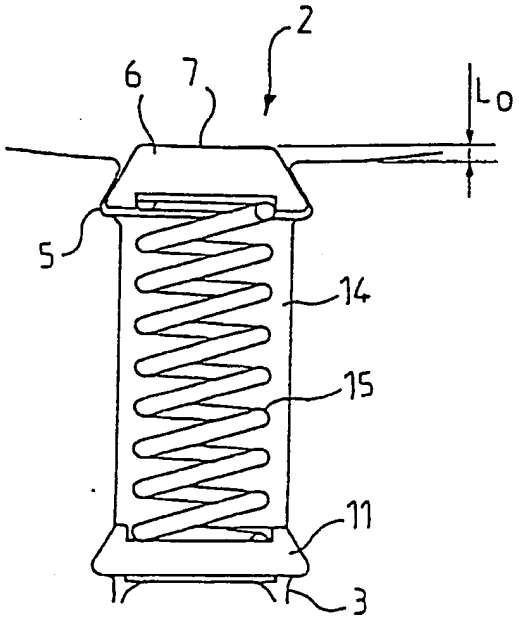

FIG. 5a

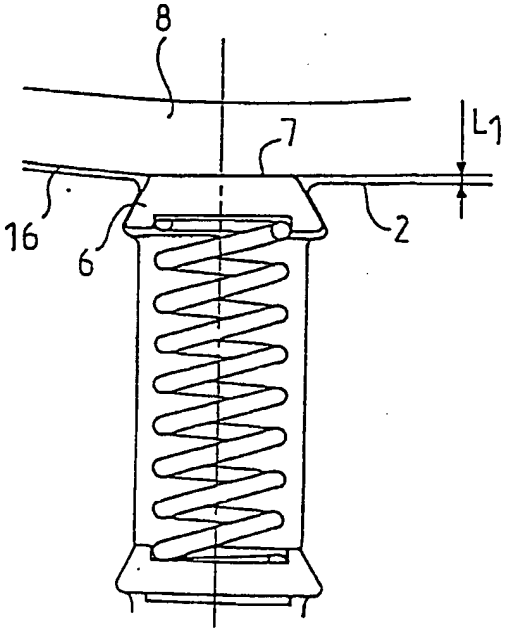

FIG. 5b

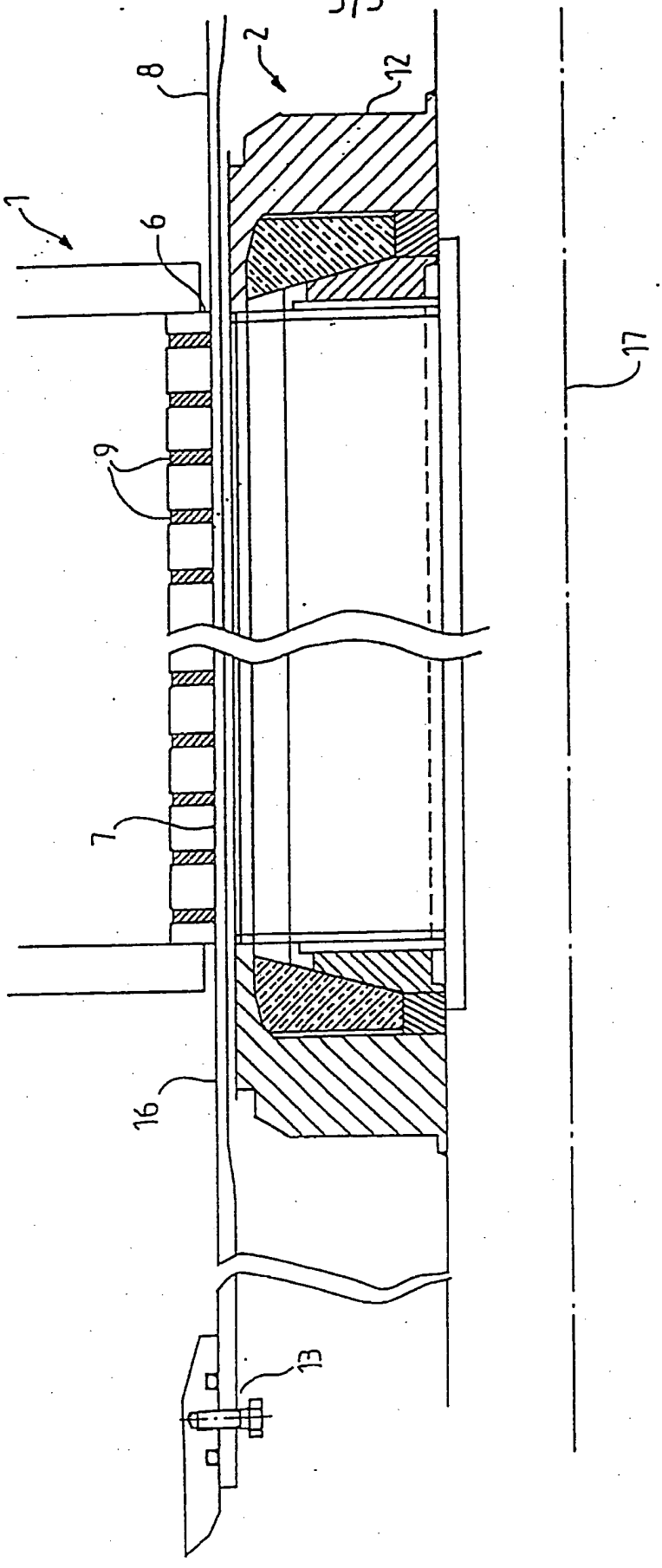

FIG. 6

"JACKETED ROTARY MACHINE"

This invention relates to rotary machines and more especially, those which exhibit a jacket in their stator bore.

Indeed, it is well-known that in all types of synchronous and asynchronous machines, service or environment conditions may require the stator to be jacketed. This is the case for engines operating in a severe environment, in chemical or polluted media, in immersed media as well as in all cases where the coil must be insulated or protected from the fluid in the airgap.

Jacketing the stator of an alternate current machine can be performed using a metal material, such as an amagnetic steel. However, such a metal part generates losses caused by eddy currents, which reduces the machine output.

This solution is only acceptable if the frequency is not too high (less than 50 Hz) and the cooling of the jacket easy. But the loss of output becomes objectionable for machines operating at higher frequencies.

Therefore, in numerous cases, one should consider the jacketing of the stator with an amagnetic and non-conducting material in order to avoid losses caused by eddy currents. Materials used conventionally are compounds and ceramics.

In order not to influence the sizing of the machines excessively and especially not to increase their diameters

too much, the thickness of the jackets foreseen in the stator bore must be low. The jackets must be supported by the sheets of the stator bore in order to resist deformations and they are shrunk inside the bore directly.

It has been noticed that conventional assemblies, with the jacket shrunk inside the stator bore, do not raise any particular problems when the jacket is made of a metal material, taking into account the similarity between the dilatation coefficients of the stator sheets and of the jacket.

These assemblies, however, exhibit shortcomings when the jacket is made of a non-conducting material.

Indeed, the materials in the machine exhibit various dilatation coefficients. Thus, under the influence of the machine warming up or of the environment, the jacket is either free inside the bore, which generates vibrations and implies rapid degradation, or compressed exaggeratedly, which leads to its fracture.

These operating defects require parts to be replaced frequently and causes long non-productive times for the equipment.

The purpose of the invention is to remedy the shortcomings exhibited by the rotary machines fitted with parts whose thermal dilatation coefficients are different, without any risks and without diminishing the machine performances, while offering a new system for installing a

jacket in a rotary machine stator bore.

The invention is especially suited for machines comprising a nonmetallic jacket, but it can also fit machines whose jacket is made of a metallic material.

Therefore, the invention relates to a rotary machine whose stator bore is designed for accommodating a jacket, the stator of said machine comprising coils retained in notches and notch closing shims, characterized in that elastic means are provided between said coils and said shims, said shims protruding from said bore and said jacket being retained elastically in the bore by the pressure exerted on said jacket by said shims.

Thanks to this elastic assembly, the jacket is never in contact with the surface of the stator bore and any possible dilatation deviations are compensated for. The jacket does not undergo any more excessive stresses during the operation of the machine.

Thus, the clearance between the jacket and the stator bore, before the jacket is assembled, is chosen in such a way that the jacket does not engage the bore, whatever the operating conditions foreseen for the machine.

Preferably, the elastic means are distributed evenly over the internal surface of the shims so that the shims exert a more or less uniform pressure stress.

According to a first embodiment, said elastic means are made of elastic strips which are arranged as a tape.

According to a second embodiment, said elastic means are made of springs.

This second embodiment is used, amongst other examples, when clearance is available between the notch shims and the coils.

The rotary machine according to the invention comprises a jacket made of an amagnetic and non-conducting material such as a compound or a ceramic material.

The invention will be understood better and other scopes, advantages and features of the said, will become clearer when reading the following description, with reference to the appended drawings on which:

Figure 1 is a partial section of a rotary machine according to the prior art perpendicular to the machine axis,

Figure 2 is a partial section of a first embodiment of a rotary machine according to the invention, perpendicular to the machine axis,

Figure 3 is a partial cross section according to III-III of figure 2,

Figure 4 is a partial section of a second embodiment of a rotary machine according to the invention, perpendicular to the machine axis,

Figure 5 comprises figures 5a and 5b which illustrate in detail the position of the notch shim, before and after installing the jacket in the stator bore, for the

machine according to figure 4 and

Figure 6 is an axial semi-section of a rotary machine according to figure 4.

The elements which are common to the various figures will be indicated by the same references.

With reference to figure 1, a conventional rotary machine comprises a stator 1, whose bore 2 is designed to accomodate the rotor of the machine which has not been shown on the figure. The magnetic circuit foreseen in the stator is made of coils 3 located in notches 4. At the end of the notches 4, beside the bore 2, dovetail recesses 5 have been designed, to accomodate shims 6.

These shims 6, commonly called "notch closing shims", enable to retain the coils in the notches 4. The outer surface 7 of the shims is arranged with minimum offset with respect to the surface of the stator bore 2. Indeed, it is necessary that the jacket bears both on the bore sheets as well as on the shims in order not to become distorted at the level of each notch.

A metal jacket is shrunk in the bore 2. Thus, the jacket 8 bears on the bore sheets.

Now, with reference to figure 2, it can be noted that in the rotary machine according to the invention, the jacket is not centred rigidly in the stator sheets, but is maintained elastically in the stator bore, thanks to a floating assembly.

This elastic centring is performed using the notch closing shims 6 which are applied against the jacket 8 while exerting a certain pressure against the said, thanks to the presence of elastic means 9.

It should be noted that the dovetail recesses 5 are identical to those arranged on a conventional machine, such as illustrated on figure 1. Conversely, the height of the shims is greated than that of the shims fitted on a conventional machine. This will appear more clearly with figures 5a and 5b.

These elastic means are arranged before assembling the jacket in the stator bore, bearing between the coils 3 on the one hand and the inner surface 10 of the shims 6 on the other hand. These elastic means 9 comprise elastic strips arranged into a tape, commonly called "ripple springs". They are distributed over the whole inner surface 10 of the shims, as can be seen more accurately on figure 3.

The figure 4 illustrates a second embodiment of a rotary machine according to the invention. This machine comprises passages 14 designed for channels enabling oil to flow. These channels have not been represented on figure 4.

Then , two series of shims located in the notches 4 have been foreseen. These shims bear the reference 11 and in this example, they provide retaining the coils in the notches 4. The purpose of the shims 6 is more particularly

to provide the continuity of the bore in order to avoid deforming or marking the jacket 8 with respect of each notch.

The elastic means, here, are made of springs 15. They are more cumbersome than the elastic strips 9 illustrate on figures 2 and 3, but can be used in this case without any problems since the space formerly provided by the passages 14, is now available.

We are now going to describe more in detail, using the figures 5a and 5b, the role and the operation of the elastic means 15 and of the shims 6, in the rotary machine according to the invention.

The figure 5a illustrates the relative position of the shim 6, of the elastic means 15 and of the stator bore 2, before assembling the jacket.

The precompressed springs 15 maintain the shim 6 against the dovetail recess 5. The height of the shim 6 has been selected so that it protrudes partially with respect to the bore 2. Thus, the portion of the shim 6 which protrudes into the bore, exhibits a height L_O, calculated with respect to the pressure that one wants to apply on the jacket, once mounted.

Let us now turn to the figure 5b which illustrates the respective position of the parts, once the jacket 8 has been installed. When inserting the jacket 8 into the bore 2, the shim 6 sags slightly and presses against the outer

surface 16 of the jacket. Thus, the shims 6 exert a pressure which is distributed over the whole outer surface of the jacket 8.

Once the jacket has been mounted, there is a residual clearance between the outer surface 7 of the shim and the bore 2, referred to as L1. This residual clearance L1, between the jacket and the bore, must be determined in relation to the foreseen dilatation deviations which depend on the operating conditions, so that the jacket must never engage the bore directly, during the operation of the rotary machine.

Thus, thanks to this elastic assembly, the possible differences between the radial dilatations of the various parts of the machine, especially the sheets of the stator bore and the jackets, are compensated for. This assembly is particularly interesting for jackets made of a non-metal material, but it can also be used for metal jackets.

The figures 5a and 5b relate to a rotary machine comprising a passage 14 between both shims, which should accommodate a channel for oil flow, such as the rotary machine illustrated on figure 4. However, the operation is identical in the case of a machine which does not contain such passages, such as the one illustrated on figures 1 to 3.

Now, with reference to figure 6 which shows the whole assembly schematically, one can see that the elastic

means, here springs 9, are distributed over the whole height of the shim 6. Thus, they exert a pressure on the shim which is distributed regularly. All the shims 6 can then exert a pressure, which is also distributed regularly, over the whole outer surface 16 of the jacket 8.

The reference 12 is the rotor, centred on the axis 17 of the machine.

The figure 6 shows that the outer surface 7 of the shim 6 engages the jacket 8. The shim protrudes moreover, with respect to the surface of the bore 2, which prevents any direct contact of the jacket 8 with the surface of the bore.

Finally, the jacket 8 is linked to the machine using conventional means, represented partially on figure 6, under reference 13.

One can note that the pressure stress exerted on the notch closing shims may be obtained by any elastic means liable to sustain the operating conditions of a rotary machine and compatible with usage in such a machine.

Such elastic means can, for instance, be made of elastic strips arranged into a tape called "ripple springs" in case when the machine does not comprise any space available between the coils and the notch closing shims. The rotary machine can then comprise a jacket which has been mounted according to the invention, without it being necessary to enlarge the notches foreseen for the coils,

which would be detrimental from an electrical point of view.

In case when the electrical machine comprises a passage between the notch closing shims and the coils, it becomes then possible to use springs as elastic means, said springs will be accommodated in the passages already provided in the machine. Springs are more cumbersome than elastic strips (i.e. "ripple springs") but, in the case of these machines, they can be used without having to modify the size of the notches foreseen for the coils.

Thus, in all cases, the rotary machine according to the invention, comprising a floating assembly of a jacket made of an amagnetic and non-conducting material, can be performed without any significative modifications of the machine structure. This is the reason why the rotary machine according to the invention provides a simple solution to the problems raised by the assembly of a jacket made of an amagnetic and non-conducting material, in the stator bore of a rotary machine.

Thanks to this assembly, the jacket cannot undergo excessive stresses any longer during the operation of the machine, caused by the differential radial dilatations of the materials used. All possible deviations are compensate for by the elastic assembly formed by the shim/elastic means combination.

Moreover, this assembly enables to maintain the

compressed coils in their notches and thus to compensate for any possible clearance arising during the operation of the machine.

The reference signs inserted after the technical data mentioned in the claims solely aim at facilitating the understanding of said claims and do not limit their extent whatsoever.

It will of course be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

CLAIMS:

1. Rotary machine comprising a stator (1) with coils (3) retained in notches (4) by notch closing shims (6) on which bears a leakproof jacket (8) located in the stator bore (2), characterized in that the shims (6) protrude from said bore (2) to avoid direct contact between the jacket (8) and the bore, and in that elastic means (9,15) are provided between said coils (3) and said shims (6), the latter exerting a pressure on the jacket (8) and while giving an elastic support, in order to compensate for any possible dilatation deviations.

2. Rotary machine according to claim 1, characterized in that the gap (L_0) between the jacket (8) and the stator bore (2), before the jacket is mounted, is selected in such a way that the jacket does not come in contact with the bore, whatever the operating conditions foreseen for the machine.

3. Machine according to one of claims 1 or 2, characterized in that said elastic means (9, 15) are distributed evenly over the inner surface (10) of the shims (6).

4. Rotary machine according to one of claims 1 to 3, characterized in that said elastic means are made of ripple springs (9).

GB.

5. Rotary machine according to one of claims 1 to 3, characterized in that said elastic means are made of springs (15).

6. Rotary machine according to claim 5, characterized in that, a passage (14) being arranged between the notch shims (6) and the coils (3), said springs (15) are located in said passage.

7. Machine according to one of claims 1 to 6, characterized in that the jacket (8) is made of an amagnetic and non-conducting material, such as a compound or ceramic material.

8. A rotary machine substantially as hereinbefore described with reference to Figures 2-6 of the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	15	Application number GB 9415514.0
Relevant Technical Fields (i) UK Cl (Ed.M) H2A (AKB2, AKB3, AKB4B2, AKB4B3, AKF1A, AKH1) (ii) Int Cl (Ed.5) H02K 03/487, 05/128		Search Examiner J COCKITT Date of completion of Search 8 SEPTEMBER 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)		Documents considered relevant following a search in respect of Claims :- 1-8

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	**P:**	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	**E:**	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	**&:**	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	US 4876469 A	(LENINGRASKOE) - see Figure 2	1 at least
Y	US 4171635 A	(KRAFTWERK) - see whole document especially column 4 lines 1-8	1 at least
Y	US 4146809 A	(WESTINGHOUSE) - see whole document especially column 2 lines 55-61	1 at least

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